

Description of three new Korean earthworms of the genus *Amyntas* Kinberg, 1867 (Oligochaeta, Megascolecidae) with multiple genital markings

Yong HONG & Won Koo LEE

Korean Institute for Biodiversity Research, Jeonbuk National University,

Jeonju 561-756, Republic of Korea.

E-mail: yhong@moak.chonbuk.ac.kr

Description of three new Korean earthworms of the genus *Amyntas* Kinberg, 1867 (Oligochaeta, Megascolecidae) with multiple genital markings.- The presence of genital markings in sexually mature *Amyntas* species provides important taxonomic characters. An unusual number or distribution of markings are of particular interest. The present paper describes three new *Amyntas* species with multiple genital markings: *Amyntas songnisanensis* sp. n., *Amyntas ephippiatus* sp. n., and *Amyntas multimaculatus* sp. n. In *Amyntas songnisanensis* sp. n. and *Amyntas ephippiatus* sp. n. the ventral zone of the clitellar segments lacks clitellar development, making the clitellum saddle-shaped. This is very unusual among *Amyntas* and the perichaetine Megascolecidae as well. Complete descriptions of the new species are provided, including illustrations of ventral view and spermathecae.

Key-words: Earthworms - Megascolecidae - Oligochaeta - Korea - genital marking - taxonomy.

INTRODUCTION

Genital markings are present in many earthworms at the period of sexual maturity. They are of especial interest to the systematist for providing some of the most useful characters for the discrimination of species (Stephenson, 1930). The location and characteristic of genital markings, while variable, can be diagnostic (Tandy, 1969). Some genital markings have glands. In *Amyntas* these glands are of two types, sessile and stalked, and they correspond approximately in number and location to the externally visible markings. The gland type and detailed structure of the stalked glands are useful characters in the genus *Amyntas*.

In this paper, we report three new species with numerous genital markings on the ventral side. Although the large numbers of markings are unusual in the genus *Amyntas*, there are previously described cases such as *Amyntas varians* (Chen, 1938) and *Amyntas kinfumontis* (Chen, 1946). The present Korean *Amyntas* species have more markings and in different locations than the Chinese species.

In two of the present species, the clitellum is not annular. *Amyntas songnisanensis* sp. n. and *Amyntas ephippiatus* sp. n. have saddle-shaped clitellums, a very rare situation in the genus, and possibly of some systematic importance. The saddle-shaped clitellum of these new species may be due to the presence of genital markings in the clitellum segments, a characteristic also unique to these species among Korean members of the genus. The type material is deposited in the Korean Institute for Biodiversity Research (KIBIO), Jeonbuk National University and in the Geneva Natural History Museum.

DESCRIPTIONS

Amyntas songnisanensis sp. n.

Figs 1 A-C

Material: Holotype and 6 paratypes: Chungchongbuk-do, Boeun-gun, Mt. Songni, 350-500 m, litter layers in forest, 26 September 1997, Y. Hong, (KIBIO). Other material: Same data as for holotype, 8 clitellate specimens; Chungchongbuk-do, Boeun-gun, Mt. Songni, litter layers in forest, 15 clitellate, 12 August 1996, Y. Hong.

Etymology: The species is named for its type locality.

Diagnosis: Clitellum saddle xiv-xvi. Spermathecal pores in 6/7, 7/8. Genital markings discrete circular spots, from viii to xix, numbers variable; 6-18 in two rows viii-xiii, 0-11 xiv-xvi, 3-6 xvii-xix, from xiv-xix generally a single row or with one or two off main row. Intestinal caecum manicate.

Description: Dimensions 56-114 mm by 4.3 mm at segment x. 5.0 mm at xxx, 5.0 mm at clitellum; body cylindrical throughout, segments 62-100. Setae regularly distributed around segmental equators, numbering 53 at vii, 50 at xx; 16-18 between male pores, regular spacing; setal formula AA:AB:YZ:ZZ = 1.5:1.5:2:3 at xiii. Female pore single in xiv, 1.2 mm oval surround with indented 0.5 mm pores. Prostomium epilobic, with tongue open. Brownish dorsally and yellowish ventrally, clitellum coffee color, formalin preservation. First dorsal pore 12/13. Clitellum saddle xiv-xvi; setae invisible externally within clitellum, but 10 setae visible ventrally xiv-xvi.

Male pores in 0.4 mm circular pits at lateral margins of ventrum in xviii, within 0.8 mm raised area. Spermathecal pores in 6/7, 7/8; dark pore within conspicuous white spot at intersegment boundary. Genital markings discrete circular spots, slightly elevated, from viii to xix, numbers variable; 6-18 in two rows viii-xiii, 0-11 xiv-xvi, 3-6 xvii-xix, from xiv-xix generally a single row or with one or two off main row. Each marking with distinct central pore, markings increase in size posteriorly.

Septa 5/6, 6/7 thick. 7/8 thin with some muscle, 8/9-10/11 thin, 12/13, 13/14 thin with muscle. Gizzard globular in viii-x. Intestine begins xv, lymph glands from xxvii. Esophagus with vertical lamellae xii-xiii. Typhlosole small from xxvii. Intestinal caecum manicate, originating in xxvii, extending anteriorly about to xxiii, each consisting of 5 finger-shaped lobes, one larger finger directed towards dorsal vessel, attached to prostates. Hearts xi-xiii esophageal, x esophageal but not seen on right; ix lateral. Male sexual system holandric, testes, funnels in ventral paired sacs in x, xi. Seminal vesicles small two pairs in xi, xii. Prostates xviii large within xvi-xxii; thick ducts, both glandular portions consist of three main lobes, each lobe divided into leaflets, each with obvious vessel.

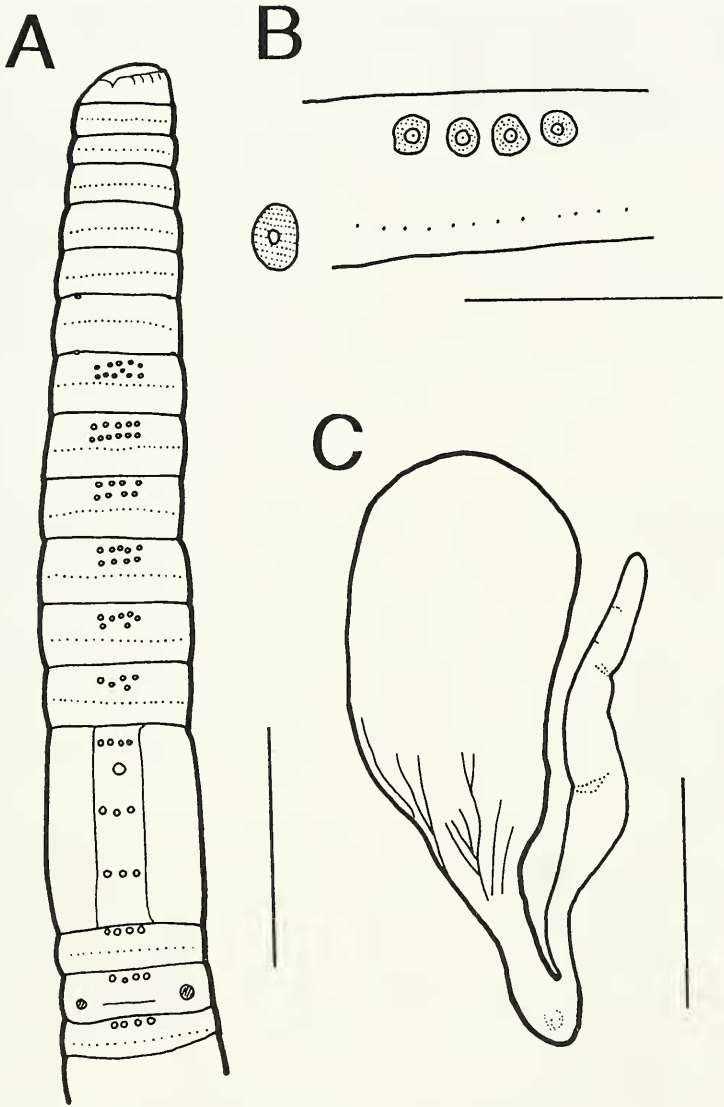


FIG. 1

Amynthas songnisanensis sp. n. A: ventral view; B: male pore region in xviii; C: spermathecae. Scales bars = 5 mm (A), 3 mm (C), 2 mm (B).

Ovaries in xiii. Paired spermathecae in vii, viii, viii flattened by gizzard; each ampulla large ovate to mitten-shaped; ducts short, thick, muscular; ectal part sharply narrowed and at right angle to main axis, diverticula stalks long, slender, chamber cayenne peppershape, as long as ampulla; no nephridia on spermathecal ducts. Genital

markings in all segments with small glands simple or lobed, stalks flat, composed of one or more canals; entire ventral body wall covered with dense clusters of mushroom-shaped glands.

Remarks: The present species appears to be closely related to *Amyntas multimaculatus* sp. n., but *A. multimaculatus* sp. n. has fewer and less extensively distributed genital markings, and the clitellum of *A. multimaculatus* sp. n. is annular. The clitellum of the present species is saddle-shaped, which is very rare among the members of the genus *Amyntas*. The male pore region surroundings are slightly elevated with a depression or invagination at the center, reminiscent of *Pheretima*, but without copulatory pouches. Aclitellates are of similar size (59-115 mm) and have the same male pore arrangement, and conspicuous genital markings from viii to xix. Aclitellate specimens only differ from clitellates by lacking the clitellum.

Amyntas ehippiatus sp. n.

Figs 2 A-C

Material: Holotype and 5 paratypes: Gyung-sangnam-do, Geochang-gun, Mt. Gaya, Haein-sa, 28 August 1968, Un-Jin Yang, (KIBIO). Other material: Same data as for holotype, 19 clitellate, 10 aclitellate specimens.

Etymology: The name *ehippiatus* is Latin for saddle, referring to the shape of the clitellum.

Diagnosis: Clitellum annular xiv or xiv-xv; saddle xv-xvi or xvi. Spermathecal pores in 6/7, 7/8. Genital markings mid-ventrally centered transverse rows or small groups ix-xii which broaden pre-setal halves of these segments; numbers 11-23 at ix, 10-22 at x, 0-15 at xi, 0-10 at xii, 0-5 at xv, 3-5 at xvi, 4-7 at xvii, 3-8 at xviii, 2-6 at xix. Intestinal caecum manicate.

Description: Dimensions 86-151 mm by 3.4-4.7 mm at segment x, 3.5-4.8 mm at xxx, 4.5-5.2 mm at clitellum; body cylindrical throughout, segments 99-105. Setae regularly distributed around segmental equators, numbering 53 at vii, 50 at xx; 14-16 between male pores, regular spacing; setal formula AA:AB:YZ:ZZ = 3.5:2:3:5 at xiii. Female pore single in xiv, 0.8 mm oval surround with indented 0.4 mm pores. Prostomium epilobic, with tongue open. Brownish dorsally and ventrally, clitellum coffee color, formalin preservation. First dorsal pore 12/13. Clitellum annular xiv or xiv-xv; saddle xv-xvi or xvi; setae invisible externally within clitellum, but 8-11 setae visible ventrally xv-xvi.

Male pores within 0.8 mm raised pad at lateral margins of ventrum in xviii; male pores in slightly invaginated circular patches 0.4 mm diameter on equator, with central white male pore. Spermathecal pores in 6/7, 7/8 on oval bumps in furrows. Genital markings mid-ventrally centered transverse rows or small groups ix-xii which broaden pre-setal halves of these segments; genital markings fewer, larger from xv to xix; all pre-setal in single row; numbers 11-23 at ix, 10-22 at x, 0-15 at xi, 0-10 at xii, 0-5 at xv, 3-5 at xvi, 4-7 at xvii, 3-8 at xviii, 2-6 at xix.

Septa 5/6, 6/7, 7/8 thin, 8/9, 9/10 absent, 10/11-13/14 thin with some muscle. Gizzard medium size in viii-x. Intestine begins xv, lymph glands absent. Typhlosole

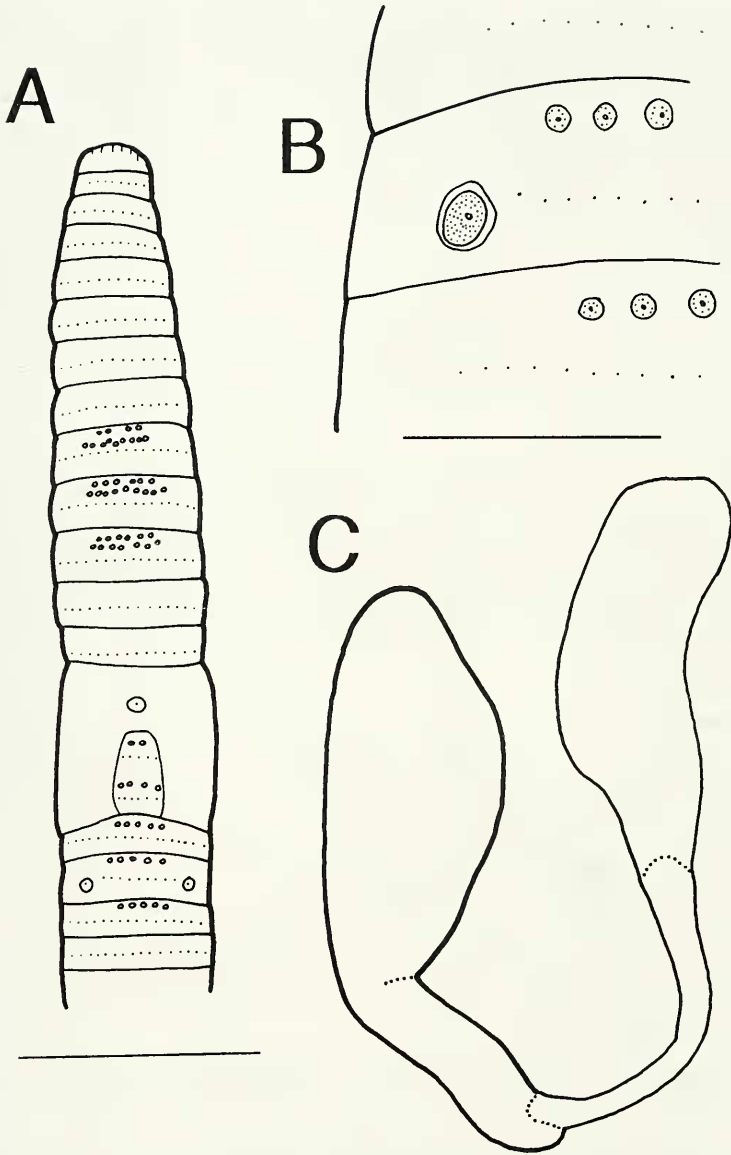


FIG. 2

Amynthas ephippiatus sp. n. A: ventral view; B: male pore region in xviii; C: spermathecae. Scales bars = 5 mm (A), 2 mm (B, C).

very small in xxvii. Intestinal caecum manicate, originating in xxvii, and extending anteriorly about to xxiii, each consisting of 6-7 finger-shaped lobes, uppermost 3 almost same size. Esophageal hearts xi-xiii, ix lateral. Male sexual system holandric, testes and funnels in paired sacs in x, sacs joined ventrally, in larger sacs enclosing seminal vesicles xi. No spermatozoal iridescence on funnels. Seminal vesicles large two pairs in xi, xii. Prostates xviii within xviii-xxi; ducts muscular, short of moderate thickness; glandular portions consist of one main solid lobe, sometimes lacking.

Ovaries in xiii. Paired spermathecae in vii, viii; each ampulla a large pouch, ducts short, muscular with 90° bend to ectal narrow portion with muscular stalk, diverticula stalks long slender, chamber cayenne pepper shape, longer than ampulla; no nephridia on spermathecal ducts. Genital papillae of ix-xii and xv-xix with small stalked glands corresponding approximately in number to the externally visible small spots; glands large blocky, angular, stalk broad, flat without circular muscle; variable size, triangular or squarish.

Remarks: The present species appears to be closely related to *Amyntas songnisanensis* sp. n., which has more genital markings on more segments. The clitellum of *A. songnisanensis* sp. n. is completely saddle-shaped, while the clitellum of the present species is partly saddle-shaped. In *Amyntas eplhippiatus* sp. n. there is a relationship between clitellum development and genital markings. When segment xv has genital markings, there is no ventral clitellar thickening in xv; otherwise, the clitellum is annular in xv.

Amyntas multimaculatus sp. n.

Figs 3 A-C

Material: Holotype and 6 paratypes: Jeollanam-do, Gurye-gun, Mt. Jiri, Piagol, 600-1,000 m, soil and litter layers, 22 August 1997, Y. Hong, (KIBIO). Other material: Same data as for holotype, 35 clitellate, 1 a clitellate specimens.

Etymology: The epithet *multiplicatus*, is derived from maculatus, the Latin for spot, with reference to the many genital markings.

Diagnosis: Clitellum annular xiv-xvi. Spermathecal pores in 6/7, 7/8. Genital markings mid-ventrally centered transverse rows or small groups xi-xv which broaden pre-setal halves of these segments; numbers 0-3 at xi, 2-40 at xii, 10-40 at xiii, 2-14 at xiv, 0-13 at xv. Intestinal caecum manicate.

Description: Dimensions 56-97 mm by 4.3 mm at segment x, 4.7 mm at xxx, 4.7 mm at clitellum; body cylindrical throughout, segments 69-92. Setae regularly distributed around segmental equators, numbering 53 at vii, 58 at xx; 14-18 between male pores, regular distance; setal formula AA:AB:YZ:ZZ = 2.5:2:2:3 at xiii. Female pore single in xiv, 0.5 mm oval surround. Prostomium epilobic, with tongue open. Red brownish dorsally and yellowish ventrally, clitellum reddish brown, formalin preservation. First dorsal pore 12/13. Clitellum annular xiv-xvi; setae invisible externally.

Male pores within 0.8 mm raised pad at lateral margins of ventrum in xviii; male patches circular 0.4 mm diameter slightly invaginated on equator, with central

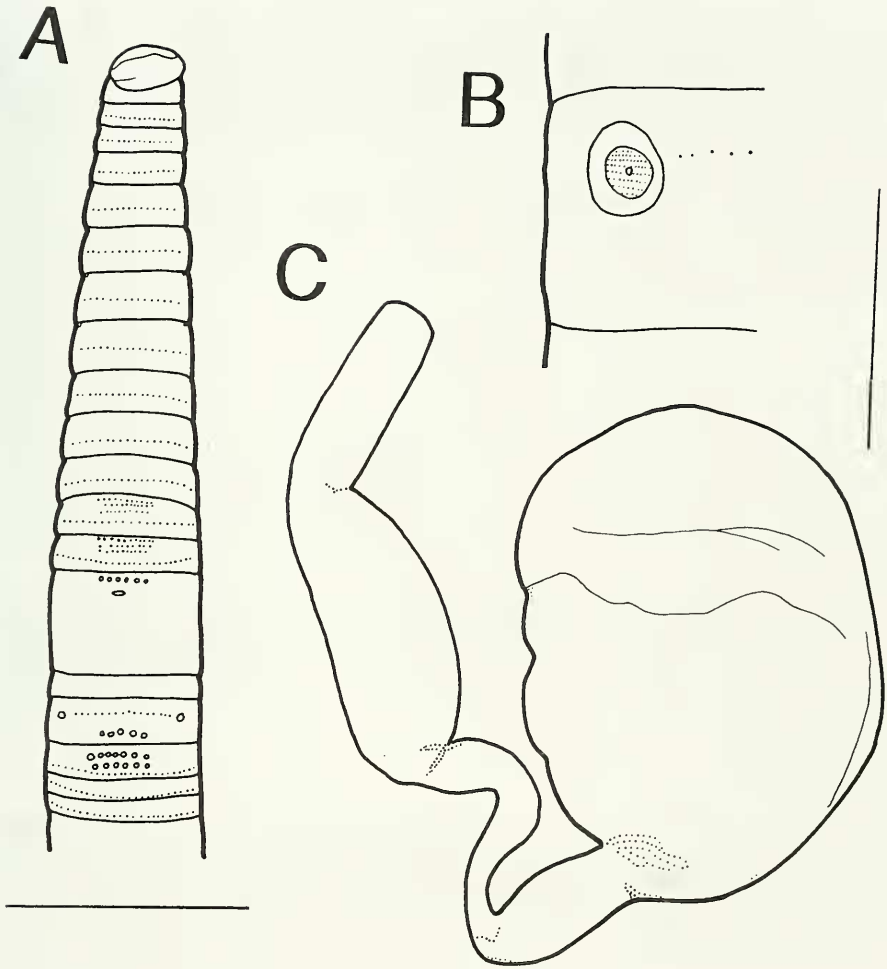


FIG. 3

Amynthus multimaculatus sp. n. A: ventral view; B: male pore region in xviii; C: spermathecae. Scales bars = 5 mm (A), 2 mm (B, C).

white male pore, 2 or 3 mid-ventral pre-setal groups of genital papillae on thickened areas in xviii-xx; segments xvii, xix shortened by enlargement of xviii. 0-8 papillae in xviii, 0-13 in xix, 0-13 in xx. Spermathecal pores in 6/7, 7/8 on oval bumps in furrows. Genital markings mid-ventrally centered transverse rows or small groups xi-xv which broaden pre-setal halves of these segments; genital markings fewer and larger in xii, xiii; smaller, more numerous posteriorly; numbers 0-3 at xi, 2-40 at xii, 10-40 at xiii, 2-14 at xiv, 0-13 at xv.

Septa 5/6 and 6/7 thick, 7/8 thin with some muscle, remnants of 8/9 may be present, 10/11-13/14 thin some muscle. Gizzard medium size in viii-x. Intestine begins xv, lymph glands small from about xxv. Small lamellae in esophageal wall xii, xiii. Typhlosole very small in xxvii. Intestinal caecum manicate, originating in xxvii, and extending anteriorly about to xxiv, each consisting of 5 finger-shaped lobes, uppermost 3 almost same size. Esophageal hearts xi-xiii, ix lateral. Male sexual system holandric, testes and funnels in ventral paired sacs in x, xi. Seminal vesicles large two pairs in xi, xii, but pushing 12/13 back to level of xiv. Prostates xviii very large within xv-xxiii; ducts muscular, short of moderate thickness; both glandular portions consist of five main lobes.

Ovaries in xiii. Paired spermathecae in vii, viii, viii larger than vii; each ampulla a large broad pouch with furrows, ducts short, muscular with 90° bend to ectal narrow portion with muscular stalk, diverticula large, red pepper shape, longer than ampulla; no nephridia on spermathecal ducts. Genital papillae of xii-xv and xviii-xx with small stalked glands corresponding approximately in number to the externally visible small spots; xii-xiv and xviii-xx; glands of xvii-xx large blocky, angular, stalk broad, flat without circular muscle; glands of xii-xiv variable size, triangular or squarish.

Remarks: The present species appears to be closely related to *A. songnis-anensis* sp. n. by genital markings, but it differs from it in the number and location of genital markings. In particular, *A. multimaculatus* sp. n. lacks genital markings in segments xvi-xvii. Another difference is the consistently annular clitellum over all of xiv-xvi in *A. multimaculatus* sp. n.

ACKNOWLEDGEMENT

We would like to express appreciation to Dr. Samuel W. James, Maharishi University of Management, Iowa, USA, who kindly made valuable taxonomic suggestions to this study. This work was supported by the grant of Post-Doc. program, Jeonbuk National University (1999).

REFERENCES

- CHEN, Y. 1938. Oligochaeta from Hainan, Kwangtung. *Contributions from Biological Laboratory of Science Society of China (Zoological series)*, 12: 375-427.
- CHEN, Y. 1946. On the terrestrial Oligochaeta from Szechwan III. *Journal of the West China Border Research Society*, 16: 83-141.
- STEPHENSON, J. 1930. The Oligochaeta. *Clarendon Press, Oxford*, 978 pp.
- TANDY, R. E. 1969. The earthworm genus *Pheretima* Kinberg, 1867 in Louisiana. *Ph. D. dissertation, Louisiana State University, Baton Rouge*, 155 pp.